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ABSTRACT

A review of some assumptions made in the development and implementation of a bilingual-bicultural curriculum for Navajo students in the early primary grades is presented. The curriculum set out to develop and expand the students' abilities for learning, teaching them how to learn, so they could cope with change. It set out to sensitize them to the two cultures, so that they could cope with both; it also set out to structure what the teachers taught and to generalize how they taught, so that the students could cope with the school situation. The basic heuristic of the curriculum is to find the inherent and make them pervasive like growing veins in the organism. It is what the curriculum considers inherent and what the curriculum has done with the inherent that will characterize the assumptions reviewed in this paper. These assumptions include: (1) Randomization of pupil participation assures individual attention for all members of the class; (2) Teaching technique affects learning ability; and (3) Teacher-student ratio affect learning progress. (Author/CK)

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ASSUMPTIONS FOR BILINGUAL INSTRUCTION IN THE PRIMARY GRADES OF NAVAJO SCHOOLS

by

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PREFACE

This paper for the Conference on Child Language is a tentative yet presumptuous beginning of a task I have set for myself: the development of a general theory of instruction. My work for the Navajo school child is also touched upon, serving as it does as the context and motivation for my work on the general theory. The result, it appears, is one of cross-purposes, but it isn't. It is a cardinal thesis of the general theory that a student is to be helped to learn primarily as a human learner, accomodating his human capabilities to the cultures that provide him with specific opportunities and limitations. For a general theory to have the potential of becoming truly universal in its application, it takes only the universal into consideration, taking particulars like specific languages, cultures, and weather conditions as situational limitations that the general theory must take into account in its formulation of the principles of implementation.

–R. D. WILSON–

OUTLINE

I Introduction: the birth of an opportunity.

II Clarification: the terms of a schema for insights.

III Definition: the interpretations of learning.

IV Stipulation: the conditions for learning.

V Limitation: the situations of learning.

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I INTRODUCTION: THE BIRTH OF AN OPPORTUNITY.

This paper is a review of some of the assumptions I have made in the development and implementation of a bilingual-bicultural curriculum for Navajo students in the early primary grades.[1] It is unlike any other curriculum in its design, in the breath of its comprehensiveness, and in the depth of its integration; yet in some way or another it is like many other courses of study both recent and ancient.

My original assignment was to develop an ESL course similar to *Starting English Early, (Wilson, et al, 1967)* one that would be appropriate to the Navajo situation. I soon realized however that what was needed was a total curriculum (all day, all subject areas, plus learning itself), needed not only for teaching English more effectively[2] but also to provide the Navajo student with the abilities for coping with the school situation, with the two cultures,and with change--the one predictable feature of the future. This realization resulted in a change of assignment: develop and implement a total curriculum--with no restrictions on the design.[3]

Simply stated, the curriculum set out to develop and expand the students' abilities for learning, teaching them how to learn, so they could cope with change. It set out to sensitize them to the two cultures, teaching them to be aware of the underlying human nature shared by the two cultures, so they could cope with the two cultures. It set out to structure what the teachers taught and to generalize how they taught, tailoring the curriculum to the children's needs as humans and as Navajos, so they could cope with the school situation. And it wove all three objectives into one design so that in the process of achieving one objective, the students were getting ready to achieve another objective; for example, cultural and human awareness predisposed them to learning, learning how to learn predisposed them to schooling, structured (alternating with unstructured) schooling predisposed them to more learning, generalized teaching methods taught them how to learn, how to learn predisposed them to learning the new culture and understanding their own, etc., etc., etc.

Making students aware of how to learn assumes their innate abilities for learning. Making them aware of the human condition that underlies the two cultures assumes a common humanity, theirs and everybody else's. Making them aware of structure in subject matter assumes their basic predisposition towards pattern--for pattern takes less storage space (than lists) and generates knowledge (*de Bono 1969*). Innate abilities, common humanity, structure in subject matter are all inherent qualities.

This is the basic heuristic of the curriculum, to find the inherent and make them pervasive like growing veins in the organism. The inherent generates. Innate learning abilities process knowledge into structure. Structured knowledge accomodates knowledge beyond itself. (Brunner 1960: Ch. 2) Humanity makes room for all cultures. And the inherent regenerates. Awareness of one's innate learning abilities, if appreciated and used, consciously used, brings about a stronger grasp of one's innate learning abilities. Awareness of structured knowledge, if appreciated and used, consciously used, brings about a greater familiarity with structured knowledge. Awareness that humanity makes room for more than one culture, the two cultures, if appreciated and (given the opportunity) used, consciously used, brings about a deeper sense of humanity. It is what the curriculum considers inherent and what the curriculum has done with the inherent that will characterize the assumptions reviewed in this paper.

One of the suspicious exercises of program writers is to claim assumptions without specifying how, specifically, they are made manifest in the program. (What, in other words, the curriculum has done with the inherent.) I will avoid this by giving examples from the methodology of the curriculum, but two things should be kept in mind. First, that one example of how an assumption is expressed in the curriculum does not list all of the ways in which the assumption is expressed in the curriculum. Second, that the derivation of a curricular expression of an assumption from the assumption is not an exercise in logic, where an expression is the only necessary derivation from a particular assumption. Rather, such derivation is the bold act of an intuition, a decision based on insufficient evidence. This second caveat is the motivation for the following section.

II CLARIFICATION: THE TERMS OF A SCHEMA FOR INSIGHTS

It took quite a while for practitioners of TESL to detach themselves from absolute faith in pattern practice. The growing concern with pattern practice finally succeeded in breaking with the faith when Clifford Prator saw pattern practice as manipulation, pointing out at the same time that all that practice was not altogether appropriate practice for a terminal objective of language, communication (Prator 1965). Prator's insight was based on implicitly seeing two levels of the pedagogical schema: manipulation as a term in a learning assumption and pattern practice as a term in an instructional hypothesis. Insights like his are more easily come by when a proper schema is explicitly available. It is the purpose of this section to propose a schema that will provide the analytical clarity needed for generating insights into pedagogical issues and, consequently, for efficiently developing curriculum, any

curriculum--and provide, as well, the terms and framework for discussing a few of the assumptions for instruction in the primary grades of Navajo schools.

The schema has four terms: learning assumption, instructional hypothesis, teaching technique, and teacher performance. A learning assumption postulates that an interpretation on the part of the learner will generate learning of some kind. An instructional hypothesis predicts the condition under which the learner's (appropriate) interpretation is likely to be secured. A teaching technique determines and projects the condition-corresponding behavior on the part of the teacher that is likely to trigger the intended interpretation on the part of the learner. A teacher's performance actualizes the technique and makes it believable, like an actor makes a role believable.

There are two theses to the schema. First, that it is the teacher's creative act in making the performance of the technique believable that triggers the intended interpretation, and the interpretation--itself a kind of learning--generates the learning promised by the assumption. Second, that each level of the schema (i.e., each term) is a system: a system of assumptions, a system of hypotheses, a system of techniques, and, even, a "system" of performance. [4]

The caveat from the preceding section bears repeating. The chain of events from the teacher's creative act to the learning promised by the assumption is as strong as the weakest link in the derivations from term to term in the schema. A derivation, say of an instructional hypothesis from a learning assumption, is not an exercise in logic, where one instructional hypothesis is the only necessary derivation from a particular learning assumption. Rather, derivation is the bold act of an intuition, a decision based on insufficient evidence.

Learning Assumptions vs. instructional hypotheses.

The confusion of learning assumptions with teaching hypotheses is apparently quite common in education, taking the form of doctrinaire instructional hypotheses. This happens because it is apparently presumed that the derivation of instructional hypotheses from learning assumptions is an exercise in logic, where one instructional hypothesis is the only logical derivation from a particular assumption. This is well exemplified in statements that inform both assumption and hypothesis as one and the same claim. For example, it is claimed that learning increases with the increase of individual attention provided in smaller classes, in smaller groups within a class, or ideally in a one teacher-one pupil ratio in a tutorial situation. The assumption:

learning increases with the increase of individual attention. The hypothesis: this increase in individual attention is effected through smaller classes, smaller groups within a class, or a tutorial situation. The doctrine: only this hypothesis will bring about the increased learning promised in the assumption.

One source of the confusion between learning assumptions and instructional hypotheses is the failure to take note that while a learning assumption is, as a rule, held true for an individual, an instructional hypothesis, in the social context of today's education, is predicted to hold true for a classroom full of pupils. So, learning increases with increase of individual attention——for the individual so attended, according to the instructional hypothesis that opts for, say, small groups in a class, in which individual attention is expressed as something physical or geographical. Thus, in a classroom full of pupils where a teacher has subdivided his class into five smaller groups, group A is getting more of the teacher's attention at any given time. Presumably, group A is increasing its learning. However, groups B, C, D, and E are meanwhile not getting the teacher's attention as implied by the hypothesis. Presumably, these groups do not profit increased learning. Indeed, these four groups profit less learning than if the teacher attended to the class as a whole, distributing what little of his attention is available to each in such a large class.[5] An important question is raised. Is the increased learning in group A alone greater or less than the increased learning for the whole class if attended to as a whole? The point here is the question, not the possible answer to the question. The question suggests that the proposed instructional hypothesis, teacher-pupil ratio, might not be adequately expressing the assumption of increased learning from increased individual attention. It implies that there might be another instructional hypothesis which would be adequate.

If individual attention is not to be expressed as something physical or geographical in the specific form of teacher-pupil ratio,how else might individual attention be expressed? Note, first, that attention implies attention felt by the students (since ineffective attention would promise no increase in learning). Note, second, that individualized attention implies attention felt by each and every student as applying to himself. Given these two observations, individual attention might simply mean that each and every child in the class believes that he has a secure place in the mind (and heart?) of the teacher. Secure. . . a guarantee that nothing, but nothing, will threaten that security, not failure to succeed, not failure to behave, not failure to conform, nothing. Such a feeling of security does not occasion remarks like "The teacher doesn't like to call on me" nor the compulsive "Teacher likes to call on me first." Appreciate the challenge of these remarks, considering that even some of the

best intentioned teachers fall into patterns of calling on mostly one category of pupils in the class. For example: mostly the brightest pupils or mostly the slowest ones because the teacher likes to provide challenge; mostly the best behaved ones or mostly the most troublesome because the teacher means to keep control; mostly the well-adjusted or mostly the maladjusted because the teacher wishes to be a parent. The challenge: "Call on me to participate on the same chance that anyone and everyone of my classmates has. Do not select among us, not even me, on the basis of any criterion whatsoever. Don't make me dependent on any criterion for a place in your mind and heart. Such dependency makes me insecure, distracting me from the objective of the lesson, from learning, and eventually from caring about learning--caring, and attending, only to the criterion you have set up."

To meet such a challenge, I have provided the curriulum with an instructional hypothesis: <u>randomization</u> of pupil participation assures individual attention for all members of the class. Randomization of pupil participation means that every child in the class has equal chances of participation, equal to every other child, virtually all the time.[6] It means, further, that every child in the class believes he has an equal chance of participation because he recognizes randomization for what it is, a game of chance. If the hypothesis is found to hold true, then, on the basis of the learning assumption that increased individual attention brings about increased learning, it may be inferred that to the degree that the pupils feel assured of individual attention, they will profit increased learning. The difference between this instructional hypothesis and that of teacher-pupil ratio is the degree to which they can assure individual attention to each and every child in the class. Whatever the difference and whichever assures greater individual attention, it has been demonstrated that more than one instructional hypothesis can be derived from one and the same learning assumption.

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Instructional hypotheses vs. teaching techniques.

However, neither the teacher-pupil ratio nor the randomization hypothesis is a hypothesis in the sense of testable, at least not by current experimental methods in pedagogy. Both of them need to be behaviorally defined. And both of them should be placed in very specific contexts, also behaviorally defined. If they are to be compared, their contexts should be identical or near identical, depending on the rigor required.

The behavioral form of an instructional hypothesis is a teaching technique, and the technique is tested in a specific teaching situation which, itself, includes other teaching techniques.

An experiment attempts to determine the effect of the teaching technique in the teaching situation. Confusion arises when the experiement is believed to have determined the effect of the instructional hypothesis rather than of the teaching technique. This is generally due to the behavioral orientation of interpreters of experiments: disinclined as they are to recognize a more general, nonbehavioral, yet insightful instructional hypothesis underlying the more specific, behavioral, also insightful teaching technique, they make the teaching technique the underlying principle itself. This confusion of technique for the more general hypothesis reveals itself among some educators in their obsession with particular media––either for or against them––for example, color coding, workbooks, primers.

The confusion of teaching technique for instructional hypothesis is sometimes traceable to the presupposition that there is only one technique for an instructional hypothesis. But this is just not the case. For example: one technique for effecting the instructional hypothesis of randomization is to have the teacher select students for participation by picking out a card from a deck of cards (like an honest card dealer would), each card with a pupil's name on it; another would be to pull out a slip of paper from a paper sack full of slips of papers with the pupils' names on them; still another would be for a blindfolded student in the middle of a circle of his peers to turn several times with one hand outstrectched, stopping to point, unpredictably, to one of them; and why not a crap game between each pupil of a pair, the winner of each pair playing against another winner, and so on until only one winner remains. All of these techniques but the last one have the advantage of brevity, leaving enough time in the period for the objective to be learned. The last one, however, will take most of the class period, leaving very little time for learning. Should the last technique be the one used in a pedagogical experiment, the effect of randomization on learning would be minimal, that is, nonsignificant. Should such an experiment be interpreted as a demonstration of the ineffectiveness of the instructional hypothesis? Or of the teaching technique?

On the other hand, a technique that is demonstrably effective in an experiment elicits a degree of confidence in the underlying instructional hypothesis––but not to the exclusion of other representative techniques that may also be demonstrably effective. The exclusion of other techniques as representative of one and the same instructional hypothesis when one technique has already been demonstrated effective probably arises when the experiment is believed to be generalizable to other contexts: that is, the same technique that proved more effective [7] in a specific

context is applicable, unchanged, to another context. The same technique may prove effective in the next context, but then again it may not. Stated this way, hypothetically, the non-generalizability of a technique elicits academic agreement to the thesis. For example, the demonstrable effectiveness of the technique of written texts for the instructional hypothesis of programmed instruction among able readers does not turn out as effective a technique among weak readers, for example, beginning ESL learners in highschool classes where number systems are taught through programmed texts in English.

The tasks of formulation and reformulation.

One can begin to appreciate the tasks of formulating and reformulating teaching techniques, instructional hypotheses, and learning assumptions by realizing the implications of the thesis that there is more than one possible derivation from term to term in the schema. This is the thesis that has been argued so far in this paper. An example of the implications of this thesis in the formulation of a teaching technique from an instructional hypothesis is here presented to plant the seed of appreciation.

The example. The questions below are relevant to the formulation of a technique (or set of techniques--depending on one's unit of behavior) for the instructional hypothesis recommending a smaller teacher-pupil ratio in a classroom, specifically, smaller groups within a class.

(a) Will the class be divided into two, three, four, five, or more groups?

(b) What criteria will be used to determine the groups?

(c) Will the pupils be informed of the criteria for the grouping? If so, how will the criteria be presented?

(d) Which sugroup will the teacher attend to first on any given unit of time, say during a day, which second, which third (etc.)? Will different groups be attended to first on different days? if so, how will this be determined?

(e) Will the teaching differ for each group or only for some of the groups, or not differ at all?

(f) Will the groups not directly attended to by the teacher at any given time be self-teaching? Or will busy work be allowed? How will self-teaching be distinguished from busy work?

Still more questions come to mind should the division of the class into small groups be changeable:

(g) Will the different groups be formed daily, weekly, or monthly? Or will some particular behavior, like a symptom, signal the need for a new division of the class?

(h) Will the same criteria to determine the groups be used each time a new division is formed? Or different criteria?

(i) Will the time taken to determine the groups at different times be significant enough to affect, negatively, the promises of increased learning? If so, how can this be avoided?

(j) Will teaching change as different groups are determined according to different criteria?

Appreciation of the tasks of formulating and reformulating the components of each level (i.e., each term)of the schema deepens with a consideration of a second thesis of the schema, that each level is a system·——a system of techniques, a system of hypotheses, and a system of assumptions. For example, take questions (e) and (j) above, both of which ask about teaching itself. If the teaching will differ for the different groups or if the teaching will change as the groups change, how will the teaching change? An entire spectrum of teaching techniques becomes a kaleidoscope of questions. And the answers to these questions, a specific set of techniques, can make or break the previously determined technique (whatever it was) for implementing the teacher-pupil ratio hypothesis. Thus, the formulation of a technique requires the formulation of other techniques related to it, that is, the task is one of formulating a system of techniques. It is easy to believe that if the teaching techniques are all of a system, the instructional hypotheses from which they are derived are quite likely to be all of a system themselves——*pari passu* for learning assumptions.

On the level of instructional hypotheses, relatedness between hypotheses can also be shown. Take the instructional hypothesis of randomization explained earlier. It gives everyone in class an equal chance to participate, yes, those who feel ready as well as those who do not feel ready. When the latter are called to participate, an important learning assumption is violated: a student must feel ready to participate if he is to improve his learning, perhaps even, if he is to learn at all. What is needed, then, is an instructional hypotheses derived from the learning assumption of felt readiness. So, I have provided the curriculum with an instructional hypothesis that purports to reflect that assumption: <u>volunteering</u> to participate. This hypothesis requires the teacher to permit a student to refuse to participate when, as a result of randomization, he is expected to participate. (It also requires the teacher to call on only those students who are volunteering to participate in the situation where only the teacher's sense of randomization is the means of selection--but this aspect of volunteering is not relevant here.) On the other hand, volunteering without randomization would make boldness a criterion for belonging, violating the learning assumption that learning comes more readily when the student feels like an individual: that he belongs simply because he is he.

The learning assumptions are systemic in that they form a hierarchy of categories. First, there are those learning assumptions which postulate the interpretations that make it possible for learning to take place: its initiation, its continuance, and its termination. Learning might be said to be initiated by interpreting a phenomenon, say something heard, as having a particular feature, for example, a car engine with a noise pattern like that of a neighbor's. The learning might be said to be continued by evaluating the feature as worthy of checking, for example: if it is the neighbor's car, he is home earlier than usual. The learning might be said to be terminated by checking the hypothesis that it is the neighbor's car or by deciding not to check the hypothesis. The latter decision leaves the individual with only an hypothesis, the former with a conclusion; in either case, learning has occurred.

Then there are those learning assumptions which postulate the interpretations that make it possible for learning of a certain kind to take place. For example, what interpretation might be postulated for product-learning that is capable of generating more learning of the product, for example, for counting 1, 2, 3, 4, etc? Possibly, it might be assumed that the interpretation of the product, the subject matter, as having structure, a principle, a generalization (and a particular one at that) is the interpretation that would make product-learning capable of generating more learning of the product; for example, to interpret counting 1, 2, 3, 4, etc. as an instance of addition by 1 (or, even more generally, of addition) would make the student capable of counting with numbers he is not familiar with, say 194, 328, 576.

There is a relationship between the two kinds of learning assumptions above. Learning assumptions that postulate interpretations which make it possible for learning to take place are prerequisites to the learning assumptions that postulate interpretations which make it possible for learning of a certain kind to take place. This seems like an obvious relationship, and it is, but it is apprently not kept in mind by some practicing educators when formulating (implicitly, probably) their instructional hypotheses (and the condition-corresponding techniques). Take the professor who describes structure XYZ of his subject matter in a lecture but fails to point out that he is describing structure XYZ or at what point in his lecture he is describing it––to initiate learning. Or take the professor who does point out structure XYZ but fails to justify, interest, or motivate the students to consider structure XYZ as worthy of checking out––to continue learning. Or the professor who does both of the preceding but fails to provide an opportunity for checking out the accuracy of the students' understanding of the structure, say by providing examples which the students have to identify as having or not having structure XYZ––to terminate learning. In any case, the relationship suggests the systemic character of the learning assumptions.

The reformulation of the components on each level may start with the learning assumptions. A new assumption may suggest itself, an established assumption may be seen in a different light, a former and rejected assumption may now appear valid. What follows is a reexamination of the system of instructional hypothesis, sometimes resulting in a modification. This, in turn, prompts a reexamination of a specific technique and the rest of the system of techniques, sometimes resulting in a new design. Or the reformulation may start with an instructional hypothesis. A particular hypothesis may be inadequate, failing to provide the stated interpretation. Or it may be superfluous, another instructional hypothesis already supplying the stated interpretation. Or one instructional hypothesis may be inconsistent with another, one nullifying the effects of the other. What follows is a reexamination of the system of assumptions and the system of techniques.

The motivation for reformulating techniques is empirical, or should be. This is the level of the schema which is testable. As the techniques of a curriculum get tested, whether rigorously or loosely, a pattern for modification may be revealed. The key to discovering a pattern and selecting the most promising new design of techniques is a familiarity with the system of instructional hypotheses from which the system of teaching techniques has been derived. Modifying the system of techniques means a reexamination of the system of instructional hypotheses, making it, in turn, subject to possible modification itself. With possibile ramifications for the system of learning assumptions.

The task of improving performance.

Awesome as the task of formulating and reformulating is in the development of a curriculum, even more challenging is the task of training teachers (or of teachers training themselves) in the performance of the techniques. It is obvious, but the parallelism should be noted, that just as there may be more than one instructional hypothesis to express a learning assumption and more than one teaching technique to give form to an instructional hypothesis, there may be more than one teacher performance for implementing a teaching technique.

Teaching performance varies from teacher to teacher and from day to day for the same teacher. It is dependent on the teacher's ability to act, to play a role more challenging than that of an actor or actress on a stage if only for the fact that the teacher's acting involves audience participation, demanding that the teacher prepare (with the help of the curriculum design) for a variety of situations. And the teacher must do this before and with an audience that must be more than entertained, an audience that must be taught so that it learns--as in the finest forms of play making. Like an actor or actress, the teacher must practice and perfect techniques, learn and identify with the role (instructional hypotheses), as well as understand and believe in the play (the curriculum). Like a Burton or a Bancroft, the teacher is a creative artist--at the performance, leaving plot and script to the playwright (curriculum designer), direction to the director (curriculum supervisor) and production to the producer (school principal).[8]

Teacher performance, like acting performance, must be credible and consistently credible in order for the pupils, like an audience, to be willing and able to interpret the act of teaching for what it is: a learning opportunity. Willingness to make learning the interpretation of the teaching act ultimately depends on the credibility of the teacher's performance. Does the manner belie the words? Does the frown belie the smile? Does even the overjoyed surprise at a pupil's unexpected correct response belie the low esteem for this particular pupil? On the other hand, the ability of the pupils to make learning the interpretation of the teaching act ultimately depends on the consistency of the credibility of the teacher's performance. Does correction always provide individualized instruction--or does it sometimes express dissappointment at the pupil for the mistake? Does the presentation of the lessons' objective always imply its importance and inherent interest--or are some lessons' objectives not really to be taken seriously as learning tasks? The recurrence of inconsistency increases the probability of error, the error of giving an interpretation other than learning to an act of teaching.

The seriousness of inconsistency is difficult to overestimate. As inconsistency repeats inconsistency in teaching, inconsistency begins to infect related areas like discipline, affection, esteem...and eventually inconsistency repeats inconsistency on all levels of communication between teacher and pupils... until finally mood and feeling alone dominate. The effect on the pupils? Anxiety.

Or, worse, as inconsistency repeats inconsistency, the importance of the teaching act, and its intended product —— learning, becomes suspect: "What does teacher really want? Not learning. Not all the time anyway. Sometimes teacher just wants me to speak up loudly. Sometimes to make mistakes...when I get something right, teacher finds some other mistake I've made...I guess I'm stupid. Sometimes to behave...calling on me when I'm not paying attention... what I say is not important so long as I start paying attention again." Learning as the meaning of class activities loses importance and other meanings for the school experience gain importance. Eventually, the primacy of learning loses its hold on the students and the primacy of conformity to teacher's wishes takes over. Only the teacher's personality can hold the class now, and if that loses its attraction (as is likely with inconsistent personalities), the pupils' chances of maturing into self-learners are those of a poker addict playing against a crooked dealer. But, unlike the poker addict who can't quit playing poker, the learning addict (he is born an addict) may very well decide to quit the game of learning when he realizes the odds against inconsistent teachers. If he is blessed with wisdom, appreciating the high stakes involved, he only quits school, not learning.

On the other hand, a consistently credible teacher, especially one so confident in his techniques that he consistently expects learning as the appropriate interpretation of his teaching, emphasizes the importance of learning, underlining it with talent, effort, time, and sincerity. There is no better way to keep students hooked on learning.

III DEFINITION: THE INTERPRETATION OF LEARNING

The title of this section is intentionally ambiguous. First, it suggests the activity of the learner in learning, as in the definition of *learning assumption* in the preceding section. Second, it suggests an understanding (mine) of the learning process: its bases, its stages, its uses. Together, the first as subject and the second as predicate, they form the proposition: "The learner learns." This is by way of saying that the purpose of this section is to provide an appreciation of the independence of the learner from teaching. (The dependence of the learner on teaching is the theme of another paper.)

Rather long quotes from the writings of Jean Piaget and Jerome Bruner will have to be made; as a pedagogue, I can only select and take the views (of psychologists) which I consider to be promising learning assumptions, promising in that they will provide me with a fertile source of effective and efficient instructional hypotheses.

The learner

The interesting thing about learning is that it occurs. It doesn't have to. Take learning as simply a changing. Changing occurs. Hit a glass bottle with a hammer and the bottle shatters. The bottle is pieces of glass. But changing does not have to occur. Hit a brass bottle with a hammer, and the bottle does not shatter. It remains a bottle. Point out a bird a child has never seen and the child learns about the bird in some visual way; but point out a bird a blind child has never seen and this child does not learn about the bird in any sense visually. Learning does occur, but it doesn't have to.

For learning to occur, there must be an organism that can learn. For specific learning to occur, there must be a learner capable of such specific learning. If learning in a specific *manner* is to occur, say visually, then there must be a learner capable of learning visually. If learning about *something* specific is to occur, say a visual image of a bird, then there must be a learner capable of learning in such a manner that learning about the something specific is possible (visually about the bird).

For learning to occur, there must be an organism willing to learn. A rat is willing to press a lever to get food, or avoid a passageway to prevent shock. For learning to occur in a specific manner, e.g., play the piano by reading notes (i.e., visually) rather than by ear (i.e., auditorily), there must be a learner willing to learn in just such a specific manner rather than the other. And if learning about something specific is to occur, then there must be a learner willing to learn about that specific something. The

blind child is unable to see the bird; the child unwilling to see the bird is just as blind. (Bruner 1968: chapters 6 & 7)

Able and willing ––and both inherent in the organism. The rat is able to press a lever though it may not know enough yet to do so; and the rat is willing to press a lever though it may not know enough yet to want to nor hungry enough to do so. The pupil is able to read though it may not know enough yet to do so; and the pupil is willing to read though it may not know enough yet to want to nor interested enough to do so. These two classes of potential functions are not learned, not from the experimenter by the rat, not from the teacher by the pupil. To say inherent of these is to say innate: in the genes. [9]

What *is* the pupil able to do?

". . . all such behavior that has innate roots but becomes differentiated through functioning contains, we find, the same functional factors and structural elements. The functional factors are assimilation, the process whereby an action is actively reproduced and comes to incorporate new objects into itself (for example, thumb sucking as a case of sucking), and accommodation, the process whereby the schemes of assimilation themselves become modified in being applied to a diversity of objects. The structural elements are, essentially, certain order relations (the order of movements in a reflex act, in a habitual act, in the suiting of means to end), subordination schemes (the subordination of a relatively more simple schema like grasping to a relatively more complex one like pulling) and correspondences (recognition, invariance, causality as in getting at things by using a stick––RDW). (Piaget 1968: 63)

This is the way the pupil begins his life as an organism. He grows, develops, matures, i.e., "becomes differentiated through functioning," by means of these very same functions and structural elements; for example:

As soon as the semiotic function (speech, symbolic play, images, and such) comes on the scene and with it the ability to evoke what is not actually perceived, that is, as soon as the child begins to represent and think, he uses reflective abstractions: certain connections are "drawn out" of the sensori-motor schemata and "projected upon" the new plane of thought; these are then elaborated by giving rise to distinct lines of behavior and conceptual structures. The order relations, for example, which on the sensori-motor plane were altogether immersed in the sensori-motor schema, now become dissociated and give rise to a specific activity of "ranking" or "ordering." Similarly, the subordination schemes which were originally only implicit now become separated out and lead to a distinct classificatory activity; and the setting up of correspondence soon becomes systematic: one/many; one/one; copy to original, and so on. (Underlines mine––RDW) (Piaget 1968: 64)

What is the pupil willing to do? In other words, if the Piagetian view of the ability to generate structures and behavior is all that the organism begins with, what explains an organism's willingness to generate specific sorts of structures and behavior and not others, human language by humans, flying by birds, and neither by horses, for instance? As Piaget puts the question to himself: "Why does it look 'as if' the results were 'predetermined'?" (1968: 62)

The behavior of the living subject depends upon quite explicit meanings; instinctual structures, for example, function in terms of all sorts of hereditary "clues"——the IRM's, "innate releasing mechanisms," of the ethologists. But meanings are implicit in all functioning, even the specifically biological distinction between normal and abnormal conditions depends on them; for example, when at birth, there is danger of suffocation, the coagulation of the blood immediately gives rise to regulation through the nervous sytem. (Piaget 1968: 48)

He is apprently unwilling to view as innate the underlying structure of behavior even while criticizing empiricism's view that all learning is dependent on the environment:

. . . what is no less essential is that contemporary ethology tends to show that all learning and remembering depend upon antecedent structures (conceivably the DNA and RNA themselves). Thus, the contacts with experience and the fortuitous modifications due to the environment on which empiricism modeled all learning do not become stabilized until and unless assimilated to structures; these structures need not be innate, nor are they necessarily immutable, but they must be more settled and coherent than the mere gropings with which empirical knowledge begins. (1968: 51)

What Piaget proposes is an innately guided (by the meanings, the clues, the IRM's) process of construction that of necessity generates species-specific structures of behavior (Piaget 1968:67, 90). It is instructive to have Piaget elaborate on this:

In the construction proposed . . . the function (in the biologist sense of the word) chiefly credited for the formation of structures was "assimilation" . . . Biologically considered, assimilation is the process whereby the organism in each of its interactions with the bodies or energies of its environment fits these in some manner to the requirements of its own physico-chemical structures while at the same time accomodating itself to them. Psychologically (behaviorally) considered, assimilation is the process whereby a function, once exercised, presses toward repetition, and in "reproducing" its own activity produces a schema into which the objects propitious to its exercise, whether familiar ("recognitory assimilation") or new ("generalizing assimilation"), become incorporated. So assimilation, the process or activity common to all forms of life, is the source of the continual relating, setting up of correspondences, establishing of functional connections, and so on . . . (1968: 71)

Note in particular the phrases, "fits these in some manner to the requirements of its own physico-chemical structures' and "produces a schema into which the objects propitious to its exercise, whether familiar or new, become incorporated," for they lead to the next question.

What is the pupil willing to do that he is able to do? For example, which of the thousands of languages he is capable of learning will he learn? Or, what does the pupil become? Piaget's view is that the organism particularizes not by itself alone but by interaction with the environment while reaffirming again the influential role of the organism's responses, influential on itself and on succeeding generations. He remarks on C. H. Waddington's work (1957):

> Waddington has shown that environment and gene complex interact in the formation of the phenotype, that the phenotype is the gene complex's response to the environment's incitations, and that "selection" operates, not on the gene complex as such, but on these responses. By insisting on this point, Waddington has been able to develop a theory of "genetic assimilation," i.e., of the fixation of acquired characteristics. Roughly, Waddington views the relations between the organism and its environment as a cybernetic loop such that the organism selects its environment while being conditioned by it. (1968: 49-50)

> Waddington, by reestablishing the role of the environment as setting "problems" to which genotypical variations are a response, gives evolution the dialectical character without which it would be the mere setting out of an eternally predestined plan whose gaps and imperfections are utterly inexplicable. (1968: 50)

Piaget is insistent on taking the learner as the controlling agent of the learning process:

> Everyone grants that structures have laws of composition, which amounts to saying that they are regulated. But by what or by whom? If the theoretician who has framed the structure is the one who governs it, it exists only on the level of a formal exercise. To be real, a structure must, in the literal sense be governed from within. So we come back to the necessity of some sort of functional activity; and, if the facts oblige us to attribute cognitive structures to a subject, it is for our purposes sufficient to define this subject as the center of functional activity. (1968: 69)

Piaget has been suggesting that the pupil brings with him all the processes and all the structural elements——the innate ability (as well as the innate willingness)——to learn species-specific behavior like language and thinking and sensory-motor skills, needing only contact with the environment, i.e., needing only experience, to particularize the language, groove the thinking, and sharpen the sensory-motor skills. Remember that Piaget's pupil brings with him only the structural elements (order, subordination, and correspondence), not structures themselves; structures (that is, particular structures, like a particular language) are constructed by means of the processes of assimilation and accomodation regulated by the pupil himself on the basis of his nature. In short, species-specific particularized structures and behavior are learned; they are not given, but they are inevitably learned. The learner learns.

The Learning.

The purpose of this subsection is rather ambitious: to provide a model of learning that takes Piaget's stages of intellectual development as the given rules of a race and Jerome Bruner's modes of representation as the tactics for running the race. It is not an explanatory model for it does not provide data about behavior needing explanation. It is not a hypothetical model for it does not provide hypotheses of the curriculum. And it is limited, providing only for the intellectual domain of the curriculum.

Piaget's work of the last thirty years has produced a description of the intellectual development of children that is consistent with the behavior of Swiss children and shows promise of being consistent with the behavior of children in other cultures, allowing for accelerations and delays. (Piaget 1970:37). It is only a promise, but it will do. I now quote Piaget, letting him describe his theory in his own words and in the least technical language I could find. (Each of the four stages will be named for later reference; they are not part of the quote.)

Sensorimotor

With perceptions and movements as its onlystools, without yet being capable of either representation or thought, this entirely practical intelligence nevertheless provides evidence, during the first years of our existence, of an effort to comprehend situations. It does, in practice, achieve the construction of schemata of action that will serve as substructures for the operational and notional structures built up later on. At this level, for example, we can already observe the construction of a fundamental schema of conservation, which is that of the permanence of solid objects . . . Correlatively, we can also observe the formation of structures that are already almost reversible, such as the organization of the displacements and positions of forward and backward or circling movements (reversible mobility). We can watch the formation of causal relationships, linked first of all to the action proper alone, then progressively objectified and spatialized through connection with the construction of the object, of space, and of time.

Semiotic

The onset of this second period is marked by the formation of the symbolic or semiotic function. This enables us to represent objects or events that are not at the moment perceptible by evoking them through the agency of symbols or differentiated signs. Symbolic play is an example of this process, as are deferred imitation, mental images, drawing, etc., and, above all, language itself. The symbolic function thus enables the sensorimotor intelligence to extend itself by means of thought, but there exist, on the other hand, two circumstances that delay the formation of mental operations proper, so that during the whole of this second period intelligent thought remains preoperational.

The first of these circumstances is the time it takes to interiorize actions as thought, since it is much more difficult to represent the unfolding of an action and its results to oneself in terms of thought than to limit oneself to a material execution of it: for example, to impose a rotation on a square in thought alone, while representing to oneself every ninety degrees the position of the variously colored sides, is quite different from turning the square physically and observing the effects.

In the second place, this reconstruction (to interiorize actions as thought--RDW) presupposes a continual decentering process that is much broader in scope than on the sensorimotor level . . . the child must not only situate himself in relation to the totality of things, but also in relation to the totality of people around him, which presupposes a decentering process that is simultaneously relational and also social, and therefore a transition from egocentrism to those two forms of coordination, the sources of operational reversibility (inversions and reciprocities).

Lacking mental operations, the child cannot succeed during this second period in constituting the most elementrary notions of conservation, which are the conditions of logical deductibility. Thus he imagines that ten counters arranged in a row become greater in number when the spaces between them are increased . . . that a quantity of liquid in glass A increases when poured into the narrower glass B, etc.,

Concrete operations

. . . there begins a third period in which these problems and many others are easily resolved because of the growing interiorization, coordinating, and decentering processes, which result in that general form of equilibrium constituted by operational reversibility (inversions and reciprocities). In other words, we are watching the formation of mental operations: linking and dissociation of classes, the sources of classification; the linking of relations A B C . . . the source of seriation; correspondences, the sources of double entry tables, etc; synthesis of inclusions in classes and serial order, which gives rise to numbers; spatial divisions and ordered displacements, leading to a synthesis of them, which is mensuration, etc.

But these many budding operations still cover no more than a doubly limited field. On the one hand they are still applied solely to objects, not to hypotheses set out verbally in the form of propositions (hence the uselessness of lecturing to the younger classes in primary schools and the necessity for concrete teaching methods). And, on the other hand, they still proceed only from one thing to the one next to it, as opposed to later combinative and proportional operations, which possess a much greater degree of mobility. These two limitations have a certain interest and show in what way these initial operations, which we term "concrete," are still close to the action from which they derive, since the linkages, seriations, correspondences, etc. carried out in the form of physical actions also effectively present these two types of characteristics.

Formal operations

. . . there begins a fourth and final period . . . characterized in general by the conquest of a new mode of reasoning, one that is no longer limited exclusively to dealing with objects or directly representable realities, but also employs "hypotheses," in other words, propositions from which it is possible to draw logical conclusions without it being necessary to make decisions about their truth or falsity before examining the result of their implications. We are thus seeing the formation of new operations, which we term "propositional," in addition to the earlier concrete operations: implications ("if . . . then"), disjunctions ("either . . . or"), incompatibilities, conjunctions, etc. And these operations present two new fundamental characteristics. In the first place, they entail a combinative process, which is not the case with the "groupings" of classes and relationships at the previous level, and this combinative process is applied from the very first to objects or physical factors as well as to ideas and propositions. In the second place, each proportional operation corresponds to an inverse and to a reciprocal, so that these two forms of reversibility, dissociated until this point (inversion of classes only, reciprocity of relationships only) are from now on joined to form a total system in the form of a group of four transformations. (1970b: 30-33)

The four stages are not to be associated with actual age groups; Piaget only claims that they occur in the sequence given (1970: 37). He provides approximate ages as guidelines, ages based on his observation of Swiss children. The sensorimotor stage begins at birth, the semiotic at about the age of two, the stage of concrete operations at about the age of seven or eight, and that of formal operations at about eleven or

twelve of which the plateau coincides with adolescence (1970: 30-33). The Navajo children participating in the curriculum at present are six and seven years old, and they will be ten when the planned five-year curriculum is completed. My (informal) observations permit me to cautiously estimate that they begin the curriculum when they are in the last mile of the semiotic stage and are well into the concrete operational stage by the end of the second year of the curriculum.

The heuristic model of learning takes Piaget's theory as constituting the rules of a race. There are just three rules. One, that there are always to be these four stages: perhaps more by a finer classification, but not less, i.e., no skipping. Two, that the four stages occur in the sequence given: sensorimotor first, semiotic second, concrete operational third, and formal operational fourth. Three, that the bottom rung of each stage is a *sine qua non* for beginning that stage: purely verbal hypotheses for the fourth stage, operational reversibility and internal representation of action (interiorization) for the third stage, language for the second, and perception and movement for the first. On the other hand, there are no rules against acceleration or deceleration, as Piaget himself has pointed out (1970: 37), nor are there rules against using a preceding stage as basis for acceleration in the following stage, as implied by Piaget's view of each stage being a preparation for the next in his description and discussion above.

Bruner, too, has developed a view of intellectual development, which he calls instrumental conceptualism:

> . . . that is organized around two central tenets concerning the nature of knowing. The first is that our knowledge of the world is based on a constructed model of reality . . . that rests on what might be called an axiomatic base . . . That is, the physical requirements of adaptive action "force" us to conceive of the world in a particular way, a way that is constrained by the nature of our own neuromuscular system. So, too, are we constrained by the primitive properties of visual, auditory, and haptic space in our effort to represent our knowledge in terms of imagery. Finally, our representation of reality in terms of language or symbolism is similarly constrained by what again seem to be our native endowment for mastering particular symbolic systems, systems premised on rules of hierarchy, predication, causation, modification, and so forth.
>
> . . . the second is that our models develop as a function of the uses to which they have been put first by the culture and then by any of its members who must bend knowledge to their own uses . . . Our instrumentalism is inherent in this double emphasis on the role of use . . . one cannot separate (except analytically) cultural instrumentalism and individual instrumentalism. (Bruner 1966: 319-320)

The parallel with Piaget and Waddington is evident: the innate necessity of choosing and performing species-specific behavior in a certain way yet modifying that behavior in a particular way in interacting with the environment; for example, the innate necessity for humans to choose to communicate through (human) language and inventing—performing it in a certain universal manner yet modifying it so that it becomes the particular language needed for a particular environment.

What distinguishes Bruner's theory from Piaget's that is of interest to the heuristic model are the three techniques Bruner posits man has for constructing a model of reality: the enactive, the ikonic, and the symbolic. Briefly, and in his words:

> . . . the means by which growing human beings represent their experience of the world; and how they organize for future use what they have encountered. There are striking changes in emphasis that occur with the development of representation. At first the child's world is known to him principally by the habitual actions he uses for coping with it. In time there is added a technique of representation through imagery that is relatively free of action. Gradually there is added a new and powerful method of translating action and image into language, providing still a third system of representation. Each of the three modes of representation—— enactive, ikonic, and symbolic——has its unique way of representing events. Each places a powerful impress on the mental life of human beings at different ages, and their interplay persists as one of the major features of adult intellectual life. (Bruner 1966:1)

To understand how these three techniques of representation serve as available tactics for running the race of learning according to Piaget's rules, one must understand representation as *act* (as Piaget would prefer) or as *medium* (as Bruner would have it) towards some *objective.* It is uninstructive to make an issue between act and medium; since Bruner infers medium from behavior (as he must, methodologically), one might agree to see the act/behavior as creating the medium/representation in the mind.[10] In explaining the three modes of representation, Bruner begins by viewing each as external:

> With respect to a particular knot, we learn the act of tying it and, when we "know" the knot, we know it by the habitual pattern of action we have mastered.
>
> Representation in imagery is just that: the picture of the knot in question, its final phase or some intermediate phase, or, indeed, even a motion picture of the knot being formed. It is obvious . . . that to have a picture before one (or in one's head) is not necessarily to be able to execute the act it represents, as those who have invested in books called "Skiing Illustrated" know all too well.
>
> The representation of a knot in symbolic terms is not so readily stated, for it involves at the outset a choice of the code in which the knot is to be described. For symbolic representation, whether in natural or mathematical "language," requires the translation of what is to be represented into discrete terms that may then be formed into "uttterances" or "strings" or "sentences," or whatever the

medium used to combine the discrete elements by rule . . . it is also necessary to specify whether one is describing a process of tying the knot or the knot itself (at some stage of being tied). There is . . . a choice . . . whether to be highly concrete or to describe this knot as one of a general class of knots. (Bruner 1966: 6-7)

But it is as "internal" that the three techniques of representation must be understood if they are to serve some objective: they must be understood as *plans* (Miller et al, 1960) by which objectives may be reached, if the individual is willing. The characteristics of internal representation are only beginning to be understood; but they show promise of being in the right direction. It is only a promise, but it will do. So, in Bruner's words (the headings are not part of the quote):

Enactive representation

When motor activity becomes "regularized" or "steady," is it converted from a "serial" to a "simultaneous" form? . . . In order for behavior to become more skillful, it must become increasingly freer of immediate or serial regulation by environmental stimuli operative while the behavior is going on. I believe that this "freedom" is achieved by a shift from response learning to place learning ——in effect, the placing of the behavior in a spatial context or "layout" that makes possible detours and substitutions to meet changed conditions . . . For example, over time all hammering behavior becomes translatable into a common schema, even though the different hammering acts may each involve different muscle groups.

(Earlier in the same chapter, page 10, Bruner provides two examples of "substitution:"

What is at first a habitual pattern for using sensorimotor activity to achieve some end later becomes a program in the sense that various "substitutes" can be inserted without disrupting the over-all act. Even a chimpanzee who is unable to get a hand into an opening to extract a desired object can substitute a stick in place of reaching. Or in skilled tool-using by humans the carpenter who forgets his plane can substitute a chisel in the smoothing routine, a pocket knife, or the edge of a screwdriver, if need be.)

It is of some comfort to quote . . . Leeper (1963, pp. 404-405) on the relation of motor activity to underlying representational process . . . "Maybe the whole point can be summed up by saying that movements often are like symbols or actually are symbols. Their significance is determined by the relations of those movements to a larger context of the situation. A person blows on his hands to warm them, he blows on his soup to cool it." (Bruner 1966: 18-21)

Ikonic representation

Perception in young children can be characterized by the following features, according to Gibson and Olum (1960): (1) it is "stuck" or nontrasformable; (2) it is "autistic" or subject to the influence of affect; (3) it is "diffuse" in organization; (4) it is "dynamic," in the sense of being closely related to action; (5) it is concrete rather than schematic or abstracted; (6) it is "egocentric," in the sense of having a central reference to the child as observer; and (7) it is marked by an unsteady attention. To this interesting list we would add one more entry: (8) the young child's perception is organized around a minimal number of cues, and these cues are usually the ones to which the child can most readily point.

. . . ---all suggest a system that, unlike the serial ordering of action and enactive representation, is labile (subject to change) and highly lacking in . . . economy . . . It is as if the young child, having achieved a perceptual world that is no longer directly linked to action, now deals with the surface of things that catch attention rather than with deeper structures based on invariant features. Or, to put it another way, it is as if the child has as its next principal task to find precisely a way of getting to the base structure of the world of appearance. In one experiment after another . . . we . . . see the younger child failing to solve problems by virtue of using surface cues while the older child succeeds by learning to respond to such "invisible" or "silent" features as relations, hierarchies, etc.

. . . the inferior conceptual performance of children with imagery preference is a result of their use of surface features in grouping.

Ostensive definition (e.g., pointing), as we shall see again and again in later chapters, is critical to the child's thinking in ikonic representation. It is only when he can go beyond this "match by direct correspondence" that he comes to deal with such "nonsensory" ideas as the relations between quantities, invariance across transformations, and substitutability within a conceptual category. (Brunner 1966: 21-29)

Symbolic representation

. . . symbolic activity stems from some primitive or protosymbolic system that is species-specific to man. This system becomes specialized in expression in various domains of the life of a human being: in language, in tool- using, in various atemporally organized and skilled forms of serial behavior, and in the organization of experience itself. We have suggested some minimum properties of such a symbolic system: categoriality, hierarchy, predication, causation, and modification. We have suggested that any symbolic activity, and especially language, is logically and empirically unthinkable without these properties.

What is striking about language as one of the specialized expressions of symbolic activity is that in one of its aspects, the syntactic sphere, it reaches maturity very swiftly. The syntactical maturity of a five-year-old seems unconnected with his ability in other spheres. He can muster words and sentences with a swift and sure grasp of highly abstract rules, but he cannot, in a corresponding fashion, organize the things words and sentences "stand for." This asymmetry is reflected in the child's semantic activities, where his knowledge of the senses of words and the empirical implications of his sentence remain childish for many years, even after syntax has become fully developed.

One is thus led to believe that, in order for the child to use language as an instrument of thought, he must first bring the world of experience under the control of principles of organization that are in some degree isomorphic with the structural principles of syntax. Without special training in the symbolic representation of experience, the child grows to adulthood still depending in large measure on the enactive and ikonic modes of representing and organizing the world, no matter what language he speaks. (italics mine--RDW)

In view of the autonomy of the syntactic sphere from other modes of operating and of its partial disjunction with the syntactic sphere, one is strongly tempted to give credence to the insistence of various modern writers on linguistics that language is an innate pattern, based on innate "ideas" that are gradually differentiated into the rules of grammer. (Bruner 1966: 47-8)

One of the striking observations Bruner makes regarding these instruments of intellect, these plans, these techniques of representation, is that——except perhaps for enactive representation——they could possibly not "occur." Ikonic representation would begin but could remain locked in by the strategy of attending only or mostly to surface features in grouping. Symbolic representation, too, would begin——language certainly——but could remain locked in by the strategy of attending only or mostly to the goals of communication and conformity that language makes possible, but not to the goal of thinking. It is this observation that makes Bruner's techniques of representation something like decision-making acts, strategies, tactics, for intellectual development. The wrong tactics can knock a pupil out of the race. The right ones help him win the race. If the rules are obeyed, Piaget will permit the runner to go faster:

> The development of intelligence, as it emerges from the recent research just described, is dependent upon natural, or spontaneous, processes, in the sense that they may be utilized and accelerated by education at home or in school but that they are not derived from that education and, on the contrary, constitute the preliminary and necessary condition of efficacity in any form of instruction. (Piaget 1970b: 36)

As plans, modes of representation are put to use to serve certain purposes, the most important of which, for the heuristic model, are the translation or transformation of one mode of representation to another. (Bruner 1966: 11, 48-49) This is a two-step process. A mode of representation guides behavior: doing, sensing, and symbolizing. The behavior in turn, creates a representation. When a mode of representation guides behavior other than the behavior specific to it, then the new kind of behavior creates the representation specific to *it*. Suppose the teacher says, "Point to the ship" or "Point to the sheep," the student's looking is guided by language and the looking creates an ikonic representation.

It should be evident that the transformation of one mode of representation to another is a combination of tactics that could just possibly accelerate the pace of a student in the race of learning. All possible transformational combinations are available to the child of school age, to the bilingual learner as well as to the monolingual. Indeed, the Navajo child has a potential advantage: he can combine the awareness of the structure of the second language (specifically, its syntax) that comes from his deliberate learning of it with an awareness of thought processes as isomorphic to that structure——*if the curriculum provides him with "special training in the symbolic representation of experience."*

From all this, from Piaget and Bruner (as I understand them), the pupil is to be taken as central: his is the ability and the willingness to initiate and incorporate learning; his are the acts that initiate and incorporate learning; his is the culture or cultures that measure his learning. Thus, that the *learner* learns is one of the assumptions. Also, that the learner *learns.*

But does the learner learn *enough*? Or, does the learner learn *well enough*? That is, on his own? In other words, can he construct a model of his experience with *all* three modes of representation? Put differently, can he reach his full intellectual potential as *homo sapiens* on his own?

> Then, if the child lives in an advanced society . . . he becomes "operational" (to use the Genevan term for thinking symbolically), and by age five, six, or seven, given cultural supports (italics mine--RDW) he is able to apply the fundamental rules of category, hierarchy, function, and so forth, to the world as well as his words. Let it be explicit, however, that if he is growing up in a native village of Senegal (Chapters 11 and 13), among native Eskimos (Chapter 13), or in a rural mestizo village in Mexico (Chapter 12) he may not achieve this "capacity." Instead, he may remain at a level of manipulation of the environment that is concretely ikonic and strikingly lacking in symbolic structures--though his language may be stunningly exquisite in these regards. (Bruner 1966: 46)

(Whether one of the ',cultural supports" needed, even in an "advanced" society, is teaching, and specifically teaching that provides "special training in the symbolic representation of experience," is the theme of another paper.)

IV STIPULATION: THE CONDITIONS FOR LEARNING[11]

A learning assumption, one remembers from section II, postulates that an interpretation on the part of the learner will generate learning of some kind. The interpretation on the part of the learner is input in a learning assumption but output in an instructional hypothesis, which, one remembers, predicts the condition under which the learner's (appropriate) interpretation is likely to be secured. This section of the paper reviews those interpretations of the assumptions of the curriculum that are derivable from the learning theories discussed in the preceding section. How the interpretations from these learning assumptions are made manifest in the curriculum will be phrased as instructional hypotheses.

It will help at this point to observe that Bruner's term, "representation," and my term, "interpretation," are equivalent. Also, Piaget's view of the learner as the "center of functional activity," i.e., as the source of learning acts, constitutes a representation the learner has of himself; otherwise, it would not be within him to be willing to learn. In my terms, the learner interprets——sees, feels, intuits——himself as the agent of learning.

The first learning assumption, then, is that the learner who sees himself as a decision-making agent of learning is willing to learn. (His willingness to learn is actualized into learning when other conditions for learning are present, but these other conditions are not relevant here except as they appear below in the explanation of the instructional hypotheses.) Two of the instructional hypotheses that express this learning assumption in the curriculum are *volunteering* and *breaks.* Volunteering was explained in section II under the heading, "The tasks of formulation and reformulation." *Breaks* predicts that pupils who are given an opportunity to decide whatever they want to do or to choose among several activities will see themselves as decision-making agents of learning. The curriculum provides for *break* time after each and every lesson. The children's decisions fall into two classes: problem-finding, i.e., deciding whatever they want to do, and problem-solving, i.e., choosing among several activities much like those independent problem-solving tasks found in Montessori classrooms. The realia for the *breaks* fall into the same two classes. For example, in the problem-solving category, a jigsaw puzzle may be chosen instead of a pair of cubes with matching equivalent number sentences. If a child chooses the jigsaw puzzle, he obligates himself to put the pieces together and form the expected picture. On the other hand, if the jigsaw puzzle is in the problem-finding category, a child who chooses that may also put the pieces

together to form the expected picture, or he might stack them up to see how high they will go (or for whatever reason he may have in mind), or he might deploy them on the floor, imagining them to be horsemen on a hunt, etc.

Another assumption stems from the learner's actions, a basic concept in Piaget's theory:

> . . . the essential fact . . . is that knowledge is derived from action, not in the sense of simple associative responses, but in the much deeper sense of the assimilation of reality into the necessary and general coordinations of action. To know an object is to act upon it and to transform it . . . To know is . . . to assimilate reality into structures of transformation, and these are the structures that intelligence constructs as a direct extension of our actions.
>
> The fact that intelligence derives from action . . . leads up to this fundamental consequence: even in its higher manifestations, when it can only make further progress by using the instruments of thought, intelligence still consists in executing and coordinating actions, though in an interiorized and reflexive form . . . intelligence, at all levels, is an assimilation of the datum into structures of transformations, from the structures of elementary actions to the higher operational structures, and that these structurations consist in an organization of reality, whether in act or thought, and not in simply making a copy of it. (Piaget 1970b: 28-29)

What this implies is that a pupil need not actually participate in the condition-response situation of a lesson himself but that he participate in such wise that the "condition-response" fact is acted upon and transformed by him. This provides the curriculum with the learning assumption that the pupil who accurately interprets the response of another pupil as either correct or incorrect himself assimilates the response. The mental transformation consists in rendering the expected response in the form of an evaluation. Observe that this rendering need not occur overtly and needs only to be intended for some sort of transformation to take place and make the response a part of the evaluating pupil. The instructional hypothesis that expresses this learning assumption in the curriculum is *evaluation.* It predicts that pupils who have been taught to expect to be asked to evaluate the response of another will interpret the response of the other pupil as correct or incorrect. It should be noted that this instructional hypothesis effects the promise of the learning assumption only for those pupils who evaluate accurately. For those who do not, another instructional hypothesis (actually a subsystem of instructional hypotheses), *correction,* provides the desired learning. One of the teaching techniques for implementing *evaluation* is simply to call on another pupil, selecting on a random basis, to evaluate the response of the (overtly) participating pupil by saying, "Is that right?" Because this is done virtually all the time, day in and day out, the procedure becomes an accepted convention to the point of being taken for granted. Any use of the procedure to embarass an erring child would not be due to the procedure as such but to the deliberate lack of charity of

the abuser--if it ever happens. Notice, too, that such a convention gets all the pupils in the class to expect to evaluate at any time, making them participate vicariously as evaluators until one of them is chosen (randomly) to overtly evaluate: everyone learns.

Bruner's three modes of representation are classes of representations, taking their form in the curriculum in many different ways. The enactive mode is particularly useful in the *pronunciation* and *rhetoric* (in the first level, dramatics) strands. The ikonic mode is itself the objective of the *visual* strand. The symbolic mode is a major objective of the entire curriculum. To explore their systematization and implementation in the curriculum is too formidable a task at present. Suffice it to say that they constitute a major portion of the system of learning assumptions on which the curriculum is based.

However, one learning assumption from Bruner's theory is too interesting to ignore. And that is: the pupil who interprets language as an instrument of thought becomes a willing builder of symbolic representation. Bruner motivates this assumption with:

> Once language is applied, then it is possible, by using language as an instrument, to scale to higher levels. In essence, once we have coded experience in language, we can (but not necessarily do) read surplus meaning into the experience by pursuing the built-in implications of the rules of language. (Italics mine--RDW) (1966: 51)

In other words, language is not necessarily applied as an instrument of thought, that is, language is not necessarily used to read surplus meaning into an experience. But, because the rewards are so great and inherent in the act itself and because symbolic representation is a natural ability available to *homo sapiens*, a realization of language as an instrument of thought should succeed in persuading the student to use language to structure his world in terms of symbolic representation.

One instructional hypothesis that grows out of this learning assumption is the prediction that pupils who are constantly expected to verbalize their school-learning experience will interpret language as an instrument of thought. Obviously, this does not prevent the children from interpreting language as a means of communication or a form of conformity. The deliberate implementation of this instructional hypothesis in a technical society might not seem too useful to Bruner:

> What has become much plainer to us in the course of our work is that there are important institutions and pressures that develop within societies of the technical type, which lead to the demand for confirmation between the three modes of knowing. Whenever learning occurs outside the

> context it will be used, outside the range of events that are directly supportive in a perceptual way or indirectly available for pointing, then language enters as a means of conveying the content of experience and of action. Under these circumstances, there is more often than not a requirement of developing correspondence between what we do, what we see, and what we say. It is this correspondence that is most strikingly involved in reading and writing, in "school learning," and in other abstract pursuits. The confrontation may not always work its way to correspondence, to be sure. (1966: 321-322)

Still, his last statement, the risk of not achieving the correspondence between enactive or ikonic representation and language, is enough motivation for the instructional hypothesis. The odds may be good, but the stakes are high. An even more important motivation for the instructional hypothesis, however, is to effect another related learning assumption as well: the pupil who constantly interprets language as an instrument of thought learns to prefer symbolic representation over the other two modes of representation. (Other instructional hypotheses maintain a sense of importance for the other two modes of representation: for the enactive mode in strands requiring performance, e.g., *music* and *rhetoric,* and for the ikonic mode in strands requiring visual structure, e.g., *geometry, rhetoric* (stage layouts with make believe props), and art activities.

The implementation of this instructional hypothesis in the curriculum is thorough. Virtually every lesson presents its objective perceptually with very carefully selected sentences to express it. The lessons that require action also provide the necessary language. Many lessons need to set up situations and the teachers use imperatives to direct the students in the set up. Most of the lessons expect the students to generate questions about actions or scenes previously associated with language of their own so that transformation from imperatives or statements to questions are the order of the day. And most importantly, this instructional hypothesis is supported by another instructional hypothesis, *correction,* which gives priority to semantic errors over grammatical or phonological ones. In other words, the correction procedure is primarily aimed at structuring experience, and structuring it symbolically, I might add.

V LIMITATION: THE SITUATIONS OF LEARNING.

Situation is context. It is a limitation only in the sense that a general theory of instruction needs to be transformed to be effective and efficient in a particular situation. Changing a situation can be one of the objectives of a theory of instruction, for example, the design of a school building could be changed to better serve learning. Still, changing the situation is but a preliminary step if and when it can be done. Very soon, and in some cases at once, attempts to change the situation cease. At this point the situation is a given. And it is neutral. Wailing and complaining about the situation may be effective for the long run, but for the here and now it is inefficient.

Situation is not always a handicap. In the case of Navajo children in American schools, creating a bilingual and bicultural situation, the situation provides opportunities for the Navajo pupil that are not available to his monolingual-monocultural fellow American. The bilingual situation provides the Navajo pupil with the opportunity to better develop symbolic representation. The theory of instruction should take advantage of this opportunity by providing the already predisposed pupil with an ESL course of study that elicits a *deliberate* learning of the second language. And it should take the same advantage of the opportunity in the other areas of the curriculum, emphasizing even more the deliberate learning of the semantics of the new language. L. S. Vygotsky, in his impressive work, *Language and Thought,* remarks:

> Specifically, our experiments brought out the following inter-related facts: The psychological prerequisites for instruction in different school subjects are to a large extent the same; instruction in a given subject influences the development of the higher functions far beyond the confines of that particular subject; the main psychic functions involved in studying various subjects are interdependent--their common bases are consciousness and deliberate mastery, the principal contributors of the school years. (1962: 102)

> (Our) chief purpose was to test experimentally our working hypothesis of the development of scientific concepts compared with everyday concepts . . . Analysis of the data compared separately for each age group . . . showed that as long as the curriculum supplies the necessary material, the development of scientific concepts runs ahead of the development of spontaneous concepts. (1962:106)

> . . . though he can correctly answer questions about "slavery," "exploitation," or "civil war," these concepts are schematic and lack the rich content derived from personal experience. They are filled in gradually, in the course of further schoolwork and reading. One might say that the development of the child's spontaneous concepts proceeds upward, and the development of his scientific concepts downward, to a more elementary and concerete level. This is a consequence of the different ways in which the two kinds of concepts emerge.

> In working its slow way upward, an everyday concept clears a path for the scientific conept and its downward development. It creates a series of structures necessary for the evolution of a concept's more primitive, elementary aspects, which give it body and vitality. Scientific concepts in turn supply structures for the upward development of the child's spontaneous concepts toward consciousness and deliberate use. (1962: 108-109)

> The influence of scientific concepts on the mental development of the child is analogous to the effect of learning a foreign language, a process which is conscious and deliberate from the start. (1962: 109)

The bicultural situation provides the Navajo pupil with an even more impressive opportunity. Consider what one culture does for an individual: "Insofar as man's powers are expressed and amplified through the instruments of culture, the limits to which he can attain excellence of intellect must surely be as wide as are the culture's combined capabilities." (Bruner 1966: 326) Imagine what two cultures could do for the individual. Consider further the rare opportunity of perceiving not just the differences between the two cultures but the deep similarities as well. In so doing the Navajo child might wonder if the similarities aren't accidental, that perhaps, just perhaps, the similarities reflect genuine human values. And one day someone will make a chance remark like "We are all brothers under the skin," a cliche, nothing more; but the Navajo child, now a little grown, will read surplus meaning into it.

FOOTNOTES

1 The original invitation by Allen Yazzie, former education officer of the Navajo Tribe, for me to participate in what is now known as the Rough Rock project eventually led to the decisions by Dr. William Benham of the Navajo Area Office of the Bureau of Indian Affairs for me to design and direct a thousand-participant workshop, two workshops for academic administrators, and the development and implementation of the bilingual-bicultural curriculum (one of a number of curricula available to his teachers) discussed in this paper.

CITE (Inc.), for Consultants In Total Education, was formed to facilitate the legal and financial processes required in undertakings such as this. Materials and services from CITE include the following: (1) Planned programs for 160 effective teaching days (approximately 1000 separate lessons) per school year for each grade level. These are produced in approximately 30 manuals. Each lesson is essentially a complete plan for the teacher and aide, including specifications of materials to be used, staging, and a brief explanation of the theory behind the instruction. Specific visuals (picture materials) and other realia are also furnished. (2) In-service training of teachers and aides. Planned in the context of specific objectives, this training provides the teacher/aide team with appropriate practice in the use of the curricula and supplies evaluation of post instruction behavior of the team as learners. Training takes the form of a summer workshop and a midyear workshop as well as clinical supervision by CITE staff and CITE-trained BIA supervisors.

2 "In the Rizal statistics there are strong implications that the degree of mastery of a language (be it Pilipino or English) that a pupil achieves depends much more on extensive use of the language than on direct language instruction. The evidence is particularly clear with regard to the mother tongue, which is, of course, almost the only language the average pupil uses outside of school hours. Conclusion 2 of the Rizal experiment states: 'The average level of literacy in Tagalog (Pilipino) *is not* closely related to the number of years in which it has been used as a medium of instruction.' In other words, the pupil learns his mother tongue largely by using it to satisfy his normal non-academic needs for communication. With regard to the second language, Conclusion 1 states: 'Proficiency in English *is* directly related to the number

of years in which it is used as the medium of classroom instruction.' A little reflection seems to resolve the apparent contradiction. It is in his subject-matter classes that the Filipino child gets his best opportunity to use English for communication purposes." (Prator 1967: vi)

[3] Except for the limitations due to the level of funding; but this was adequate if not generous.

[4] The level of performance is also systemic, requiring a coordination of skills and a recurring pattern of such coordination in order for the performance to be effective and consistently effective. This is implied in the section, "the task of improving performance." The reason for discussing performance separately from the other levels is that the others are more amenable to analytic systematization while performance is more amenable to synthetic systematization.

[5] Perhaps, if the children in group B through E are self-teaching rather than simply keeping out of the teacher's way with busy work, some amount of increased learning can be claimed, that is, if.

[6] No one instructional hypothesis can dominate all of the class time; otherwise, other useful hypothesis would have to be excluded. The effectiveness of an instructional hypothesis often depends on the presence of another instructional hypothesis (or more) in the same teaching situation. In this case, Randomization is related to Volunteering (to be discussed on pp. 9)

[7] The notion of inference from sample to population (parameter) in experiments on human behavior is currently being debated; cf. Denton E. Morrison and Ramon E. Henkel (eds.), *The Significance Test Controversy* (1970).

[8] A similar comment was made by Bernard Spolsky in "An Evaluation of Two Sets of Materials for Teaching English as a Second Language to Navajo Beginners," Final Report, BIA Contract No. NOO C 1420 2415, June 13, 1969. The comment:

"To what extent does a precise curriculum free a teacher, and to what extent does it bind her? A difficult question to answer in the abstract, but in practice much simpler than it appears. An excellent teacher with unlimited preparation time will be more creative with less guidance, but the average teacher, with a full teaching day, performs best when she is called on to "perform" rather than "compose". The musical analogy is reasonable: one senses individual interpretative creativity in a performer of a piece of music rather than in an improviser. In practice, I felt more individual variation, more evidence of teacher personality, in those using the Wilson than in those with . . . materials.

[9] "Having solely a genetic basis.' This is what I, and I believe most geneticist and psychologists, ordinarily understand by the term (innate). According to this definition, only the genes are innate." (Braine 1971: 184)

[10] Though Piaget reportedly "doubts whether. . . enactive representation ought to be called representative at all," (Bruner 1966: 10)

[11] The title of this section refers to the conditions stipulated in instructional hypotheses. It is intended to emphasize the importance of converting learning assumptions into instructional hypotheses, even in a paper on learning assumptions if the paper is intended as a paper in education. A remark by Bruner is appropriate here:

> One might ask why a theory of instruction is needed, since psychology already contains theories of learning and of development. But theories of learning and of development are descriptive rather than prescriptive. They tell us what happened after the fact; for example, that most children of six do not yet possess the notion of reversibility. A theory of instruction, on the other hand, might attempt to set forth the best means of leading the child toward the notion of reversibility. A theory of instruction, in short, is concerned with how what one wishes to teach can best be learned, with improving rather than describing learning. (Bruner 1968 : 40)

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